



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

The following summary and conclusions are offered : —

I. That the mechanical force used in locomotion during the struggle for existence has determined the digits which are now performing the pedal function in such groups as have undergone digital reduction.

II. That where the distribution of mechanical strains has been alike upon all the digits of the manus or pes, or both, they have remained in a state of approximate uniformity of development.

III. It is held that these views are Lamarkian and not Darwinian, that is, that they more especially take cognizance of mechanical forces as mutating factors in evolution, in accordance with the doctrine of the correlation of forces.

ON THE DISTRIBUTION OF FRESH-WATER FISHES.

BY DAVID S. JORDAN.

THE writer has been engaged during the two past summers (1876-1877) in collecting fishes in the upper waters of the different river basins in the Southern States, with a view to ascertaining the fish fauna of each and to throw as much light as possible on the laws which govern the distribution of the species. In 1868 and 1869, Professor Cope made very thorough explorations of the upper waters of the Cumberland, Tennessee, Kanawha, James, Roanoke, Neuse, Great Pedee, and Santee. In order to supplement Professor Cope's work, the writer, with his ichthyological assistants, Prof. A. W. Brayton and Mr. C. H. Gilbert, began with the Santee, and proceeded westward across the different river basins, including the Santee, Savannah, Oconee, Ocmulgee, Chattahoochee, Alabama, Tennessee, Cumberland, and Ohio. These rivers, as well as those examined by Professor Cope, have their rise in the Alleghany Mountains, from which they flow in different directions and under the most widely varied physical conditions, thus affording the most favorable opportunity for the study of the effect of these conditions on the distribution of fishes.

Some forty-three species new to science were obtained by us in these Southern rivers, among them several singular and interesting forms, but of these I do not purpose to speak at present. I shall confine myself to the statement of a number of propositions — apparently truths — in regard to the distribution of

fishes, which have been drawn from my own experience as a collector. In these, I have had reference chiefly to the smaller or non-migratory species, the *Centrarchidæ*, *Etheostomatidæ*, and *Cyprinidæ*. The larger species are generally too little known or are too widely distributed to be especially considered here.

The theoretical questions of how fishes have become dispersed, or how and why they have in past time extended their range, I do not propose to discuss. These points and others noticed below have been ably treated by Professor Cope.¹

It may be premised that some of the propositions contained in the following pages are probably only half truths, to be more completely stated as our knowledge increases.

I. In the case of rivers flowing into the *ocean* the character of the faunæ of the upper waters compared one with another bears no or very little relation with the places of discharge. An illustration of this may be taken in the general similarity of the faunæ of the Youghiogheny and Upper Potomac rivers, — or in the greater resemblance existing between the faunæ of the Chattahoochee and Ocmulgee than between those of the Chattahoochee and Alabama. The Wisconsin River and the Red River of the north have a very similar fauna.

II. River basins having a similar discharge into some larger river or lake have a similarity of fauna due to this fact, and in general, other things being equal, the nearer the points of discharge, if in *fresh water*, the greater the resemblance. The almost identical fauna of the Catawba and Saluda will exemplify this.

III. The higher or the older the water-shed between two rivers, the fewer species are common to both. (This needs further investigation.)

IV. Certain species — not including “species of general distribution” — occur on opposite sides of even the highest water-sheds. This fact was first noticed by Professor Cope. The occurrence of *Luxilus coccogenis* and *Hybopsis rubricroceus* in the Tallulah and Little Tennessee rivers will illustrate. Neither species is known as yet from any river basin other than the Savannah and Tennessee. The existence of *Platygobis gracilis* in the upper waters of the Missouri and Colorado is another illustration.

V. When the water-shed between two streams is a swampy upland instead of a mountain range, the same species will be

¹ Journal Acad. Nat. Sci., Phila., 1868, pp. 239-247.

found in the head waters of both, although the faunæ of the lower courses may be different. In case the one stream flows northward and the other southward, the common fauna will be essentially that of the northernmost stream.

In Northern Indiana, the same species occur in the head waters of the St. Joseph's, Maumee, Wabash, and Illinois rivers, although these streams discharge their waters in widely different directions. This is accounted for in the fact that the swampy watershed is often overflowed, affording in the spring an easy water communication.

VI. Many species inhabiting small tributaries of any river are different from those abounding in the river channels. This fact is well known.

Among the brook species may be enumerated *Eucalia inconstans*, *Chrosomus erythrogaster*, *Pœciliichthys spectabilis*, *Xenotilichthys chloris*, *Semotilus corporalis*, *Xenisma stellifera*, *Salmo fontinalis*, the species of *Rhinichthys*, etc., etc. Of the channel species, such as *Hyodon*, *Haplodonotus*, *Dorysoma*, *Pomolobus*, *Roccus*, all the buffalo-fishes and the larger cat-fishes, *Ichthaelurus punctatus*, *Pelodichthys olivaris*, *Amiurus nigricans*, and the like will serve as examples.

VII. Many species inhabiting the upper course of a stream are different from those of the lower. This subject has been well discussed by Professor Cope,¹ but further investigations, especially of the rivers of the Southern States, are much to be desired.

VIII. This difference in the upper and lower faunæ is due chiefly to differences in physical conditions of either water, riverbed, food, or climate.

IX. Hence, if in the same river basin there are two streams flowing into the larger stream, the one near the source, the other near its mouth, and these two streams are similar in all known physical respects, their faunæ will be similar, and if dissimilar they will have different faunæ. The general identity of the fishes of Elk River in Western Tennessee and those of Powell's River may be noticed in this connection.

X. Some species of fishes are confined strictly to a single river basin, while others, with apparently no better means of defense or of diffusion, are widely distributed, inhabiting many rivers. In illustration of this the narrow range of each of the colored species referred to *Photogenis* may be compared with the range of *Luxilus cornutus*, which extends from Maine to Arkansas and Montana.

¹ Loco citato.

In the genus *Nocomis* (*Ceratichthys* Baird) *N. biguttatus* probably occurs in every river from Pennsylvania to the Great Salt Lake, while four species of the same genus, *N. micropogon*, *N. monachus*, *N. zanemus*, and *N. labrosus*, are each, so far as is known, confined to a single river basin.

XI. In any river basin the most abundant species (of small fishes) are usually (*a*) those peculiar to it, or some of them; or (*b*) those of the widest distribution. In illustration of this we may notice the abundance of "*Photogenis*" *pyrrhomelas* and *Nototropis photogenis* in the Santee; of "*Photogenis*" *stigmaturus* and *Luxilus cornutus* in the Alabama; of "*Photogenis*" *eurystomus* and *Nocomis biguttatus* in the Chattahoochee; of "*Photogenis*" *xenurus* and *Notemigonus Americanus* in the Ocmulgee. To this rule, however, there are many exceptions and modifications.

XII. In general, the further south any river basin lies, the more species are peculiar to it and the greater the difference between its fauna and that of the neighboring streams. In illustration of this, the differences existing between the faunæ of the Alabama and Chattahoochee may be compared with those between the Susquehanna and the Delaware. Twelve genera are known as common to the Alabama and Chattahoochee, twenty-three to the Susquehanna and Delaware. In the Southern streams, the process of evolution of specific forms seems to have progressed more rapidly.

XIII. Species of the widest distribution often have breaks in their range which cannot be accounted for by any facts now in our possession. *Luxilus cornutus*, — the common shiner or red-fin of New England, — so abundant in all the rivers of the North and West, does not occur, so far as is known, in any of the rivers between the Neuse and the Alabama, in both of which streams it is very numerous. Various other species range over several river basins and then cease abruptly. *Amiurus brunneus* is the most abundant food-fish in the rivers from the Santee to the Chattahoochee, while in the next river westward — the Alabama — it is unknown.

XIV. Many species of wide distribution which are absent in certain streams are there represented by certain other related species which may be regarded as modified descendants. Thus, in the South Atlantic streams, *Chænobryttus gulosus* is represented by *Chænobryttus viridis*, *Notemigonus chryssoleucus* by *Notemigonus Americanus*, etc. In the Southwest, *Eupomotis aureus* is

represented by *Eupomotis pallidus*. In the West, *Noturus gyrinus* by *Noturus sialis*, *Noturus insignis* by *Noturus exilis*, *Umbra pygmaea* by *Umbra limi*.

XV. Other species under similar circumstances have no such "representatives." The case of *Luxilus cornutus* will again illustrate.

XVI. Certain species have been known to extend their geographical range since the opening of the canals. Such are more especially migratory species of probably marine origin, as, for example, *Dorysoma heterura*, *Pomolobus chrysochloris*, and *Anquilla vulgaris*, now abundant in Lake Erie and Lake Michigan, but formerly unknown there. The range of certain *Percidæ* and *Centrarchidæ* has been extended by the same means.

XVII. Rivers flowing parallel into the same larger stream have more in common than rivers having their mouths nearer together but flowing from opposite directions. The Wabash and Miami have more in common than either has with the Kentucky.

XVIII. The characteristically American forms of fishes are, generally speaking, rare or absent in the waters of New England and of the Pacific slope. This fact has been apprehended by Professor Agassiz, who called New England "a zoölogical island."

About one hundred and five genera of fresh-water fishes inhabit the waters of the United States, east of the Mississippi River. Of these, the following seventy-seven do not occur in New England (exclusive of Lake Champlain and tributaries of the St. Lawrence) :—

Potamocottus,	Stizostethium,	Typhlichthys,	Gila,
Cottopsis,	Micropterus,	Chologaster,	Nocomis,
Trigloopsis,	Ambloplites,	Astyanax,	Ericymba,
Ammocrypta,	Acantharchus,	Percopsis,	Exoglossum,
Pleurolepis,	Chænobryttus,	Thymallus,	Lagochila,
Percina,	Apomotis,	Hyodon,	Placopharynx,
Alvordius,	Xenotis,	Campostoma,	Myxostoma,
Ericosma,	Xystroplites,	Hybognathus,	Cycleptus,
Hadropterus,	Mesogonistius,	Pimephales,	Carpiodes,
Imostoma,	Hemioplites,	Hyborhynchus,	Ichthyobus,
Rheocrypta,	Copelandia,	Hybopsis,	Bubalichthys,
Ulocentra (Jor. MSS.),	Centrarchus,	Lythrurus,	Ichthælurus,
	Pomoxys,	Cyprinella,	Pelodichthys,
Diplesium,	Haploidonotus,	Erogalia (Jor. MSS.),	Noturus,
Nanostoma,	Aphododerus,		Amia,

Nothonotus,	Eucalia,	Nototropis,	Lepidosteus,
Pœcilichthys,	Labidesthes,	Cliola,	Litholepis,
Etheostoma,	Xenisma,	Phenacobius,	Polyodon,
Microperca,	Zygonectes,	Chrosomus,	Scaphirhynchops.
Elassoma,	Amblyopsis,	Phoxinus,	

Of the genera found in New England, only *Salmo*, *Esox*, *Rhinichthys*, and perhaps *Amiurus* are represented by more than one species. From thirty to thirty-five genera occur in the waters of the Pacific slope.

XIX. The larger the river basin, the greater its variety of forms, — both generic and specific. Compare the number of species inhabiting any of the tributaries of the Mississippi with those of any eastern river. Seventy species have been taken in the little White River at Indianapolis, representing forty-eight genera, twice as many as occur in all the rivers of New England.

XX. Other things being equal, a river whose course lies in a region of undisturbed stratified rocks or of glacial drift contains most genera and species.

XXI. Conversely, rivers whose courses lie over igneous or metamorphic rocks contain fewest species. Such rivers often contain great numbers of individuals.

XXII. Sources of streams on opposite sides of a high watershed often have species in common which do not occur in the lower courses of the same rivers. Some mountain species, as *Salmo fontinalis* and *Hybopsis rubricroceus*, exemplify this.

XXIII. Certain species have a compact geographical range, occurring in all waters within this range, without apparent regard to the direction of their flow. Such are *Lepiopomus obscurus*, in the Alabama, Tennessee, and Cumberland, and *Hybopsis microstomus* in the James, Roanoke, Kentucky, Cumberland, and Clinch.

XXIV. Certain species have a wide east and west range, apparently regardless of the course of the rivers, but are bounded on the north or south by parallels of latitude.

Eucalia inconstans is found from Western New York to Kansas, and northward — but never southward — of a line passing about fifty miles south of Lake Erie. *Percopsis guttatus* has a like range, but its southern boundary is in the Potomac and Ohio. *Lota lacustris* is similarly circumscribed. The three species of *Lythrurus* have each a belt of latitude, — *L. cyanocephalus* belonging to the Great Lakes and Upper Mississippi, *L. diplæ-*

mius to the Ohio and Potomac, *L. ardens* to the Cumberland, Roanoke, and James.

XXV. Certain species have a peculiar northern and eastern range, occurring in the Upper Mississippi, in the head waters of the Illinois, Wabash, and Scioto, thence through the Great Lakes and New England, thence to South Carolina on the eastern slope of the Alleghanies. Such are *Perca Americana*, *Eupomotis aureus*, and *Amiurus catus*.

XXVI. Certain species have a peculiar northern and western range, occurring in the Middle States and in the Great Lakes and usually southward in the east to some point in Virginia or North Carolina, ceasing in the same latitude on both sides of the Alleghanies, but extending southwestward through the Mississippi Valley to the Gulf. Among these may be mentioned *Luxilus cornutus*, *Notemigonus chrysoleucus*, *Ambloplites rupestris*, *Apomotis cyaneus*. The last-named species, however, scarcely extends east of the Alleghanies.

XXVII. Certain species have a wide range north and south, either east or west of the Alleghanies, which do not cross that chain. Of these may be mentioned *Lepiopomus auritus*, *Enneacanthus obesus*, *Aphododerus Sayanus*, *Esox reticulatus*, etc., on the east, and *Haploidenotus grunniens*, *Hyodon tergisus*, *Noturus miurus*, *Noturus sialis*, etc., on the west.

XXVIII. The distribution of fresh-water fishes is dependent on (a) fresh-water communication ; on (b) character of stream, that is, of water, as to purity, depth, rapidity, vegetable growth, etc. ; on (c) the character of the river bed, as to size, condition, of bottom, etc. ; on (d) climate, as determined by latitude and by elevation above the sea ; and finally on (e) various unknown factors arising from the nature or the past history of the species in question, or from the geological history of the rivers.

RECENT LITERATURE.

AMERICAN INSECTIVOROUS MAMMALS. — Dr. Coues has recently published a preliminary paper on the American Insectivora,¹ in which are described three new subgenera and five new species of *Soricidæ*.

¹ *Precursory Notes on American Insectivorous Mammals, with Descriptions of New Species*. By ELLIOTT COUES. Captain and Assistant Surgeon United States Army, Secretary and Naturalist of the Survey. Bulletin U. S. Geology and Geographical Survey, vol. iii. No. 3, pp. 631, 653. Department of the Interior: Washington. May 15, 1877.